CLAIRE
Clinical AI Research

The All-in-one AI-based Knee Osteoarthritis Management System

Solving clinical problems with artificial intelligence

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEEP TECH PIONEERS
hello tomorrow

TechConnect INNOVATION AWARD 2020

SIE FUND
社創基金

HONG KONG ICT AWARDS 2021 香港資訊及通訊科技獎

HUB FOR THE FUTURE 「滙聚人才創未來」計劃
滙豐 HSBC
香港青年協會 the hongkong federation of youth groups

Our Team (Established since August 2020)

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Clinical Team

Dr. Chunyi Wen
(MB.BS, M.Med.Sc., Ph.D.)
Project Supervisor

Associate Professor at the Department of Biomedical Engineering in PolyU

Toby Li
Co-Founder, CEO

Strong biomedical background with medical device regulation knowledge

Yoyo Wo
Clinical Advisor (Occupational Therapy)

A student in Occupation Therapy with community healthcare background

Abu Chan
Clinical Advisor (Physiotherapy)

A learning-driven physiotherapy student relishes challenges

Rachel Lui
Clinical Advisor (Physiotherapy)

A Physiotherapy student who is passionate to serve our society

Natalie Tang
Clinical Advisor (Physiotherapy)

An energetic student ready to devote to and get inspired in the medical world

Marketing & Communication Team

Lucy Ng
Founding Member, Creative Director (UX/UI)

Rich exposure in informational technology industry as a graphic designer

Jacky Wu
Director of Marketing and Communication

Experienced in business optimization and project management on innovative technologies

AA Wong
Digital Creative Specialist

Experienced in creating and editing digital production work

R&D Team

Justin Chan
Co-Founder, COO

Strong background in data science and machine learning

Alex Zhang
Research Director (Machine Learning)

Dedicated to building machine learning models for gait analysis based on biomedical engineering knowledge

Joffy Lau
Research Director (Database Management)

Adept at database management

Andrew Leung
Research Director (Biotechnology)

Graduated with the First-Class Honour in Biotechnology

Business Team

Karen Wong
Founding Member, CFO

Extensive sales & marketing background with rich experience in coordinating market research activities

Clarice Yip
CBDO (Chief Business Development Officer)

Profound supply chain management background

Tiffanie Li
Director of Corporate Strategy

Demonstrated Business Analytical student specialised in International Shipping Logistics industry

Lulu Keung
Finance Manager

Business administration background with focuses on accounting and finance

What is Knee Osteoarthritis (KOA)?

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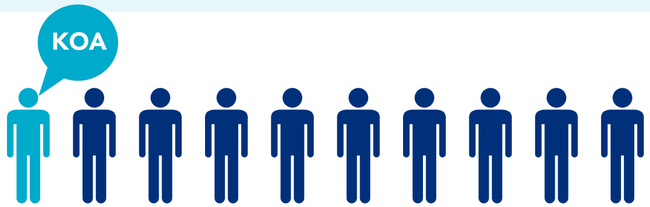
A **chronic degenerative disease** with **no cure**.



10% Population suffer from KOA

Global and **Hong Kong** KOA Prevalence

66 months

Average waiting time for joint replacement surgery

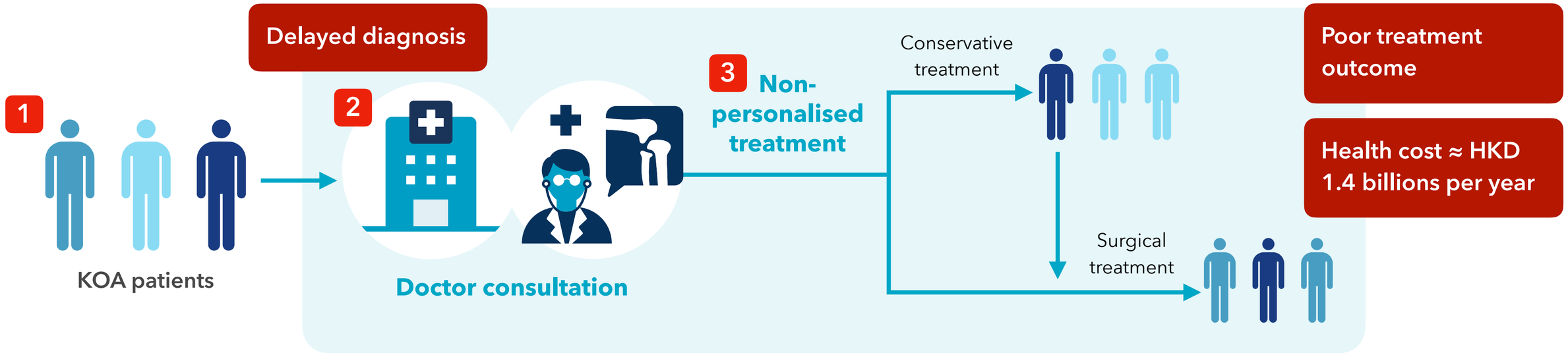
KOA threatens healthy ageing and holistic wellbeing

Dementia and **depression**

Knee pain and **disability**

Low mobility for **social interaction** → Reduced **self-efficacy**

Problems Faced by Patients and Doctors



Problem 1

No self-management support

+

Problem 2

No prediction tool

+

Problem 3

No personalised treatment

Irreversible knee damage;

Expensive and risky joint replacement surgery (HKD 400,000 each)

Early Stage

Late Stage

* Most diagnoses take place

Product Solutions

The Asia First AI-based KOA Management System

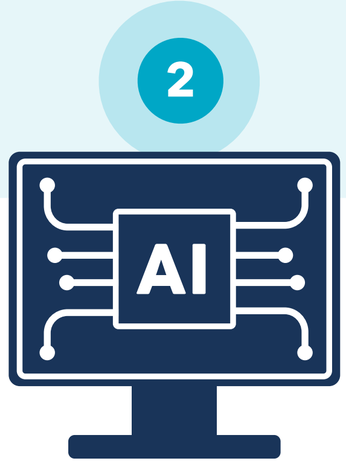
1

AI-based Video Gait Analysis System

Preliminary Screening;
Functional Outcome Measurement

Therapist

2

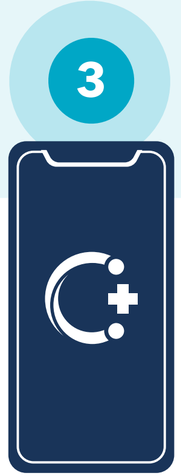


AI-based KOA Prognostic System

Early Diagnosis;
Personalised Treatment

Doctor

3



KOA Mobile Application

Self-management;
Streamlined Medical Support

Public

Data Acquisition

- **>20,000** KOA subjects
- **>80%** Prediction precision
- Trained by **US & HK Dataset**

- State-of-the-art

Implementation in Primary Healthcare

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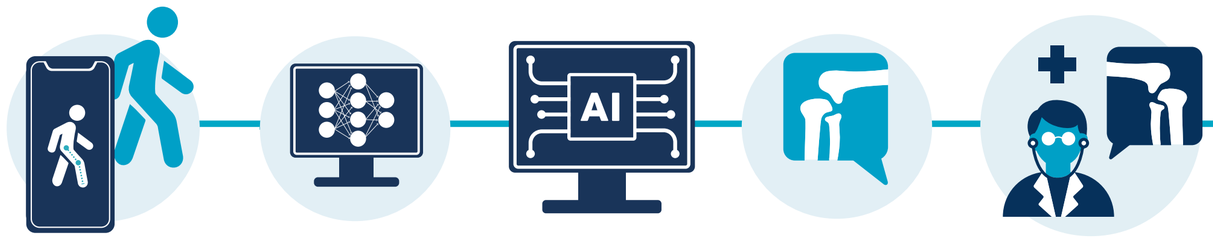
Low-cost, Reliable Health Assessment

Community screening center



Walking Pattern Recording with mobile devices

Self-administered Health Survey

AI System

KOA Risk Assessment

Therapist's consultation

Low-risk Case

High-risk Case

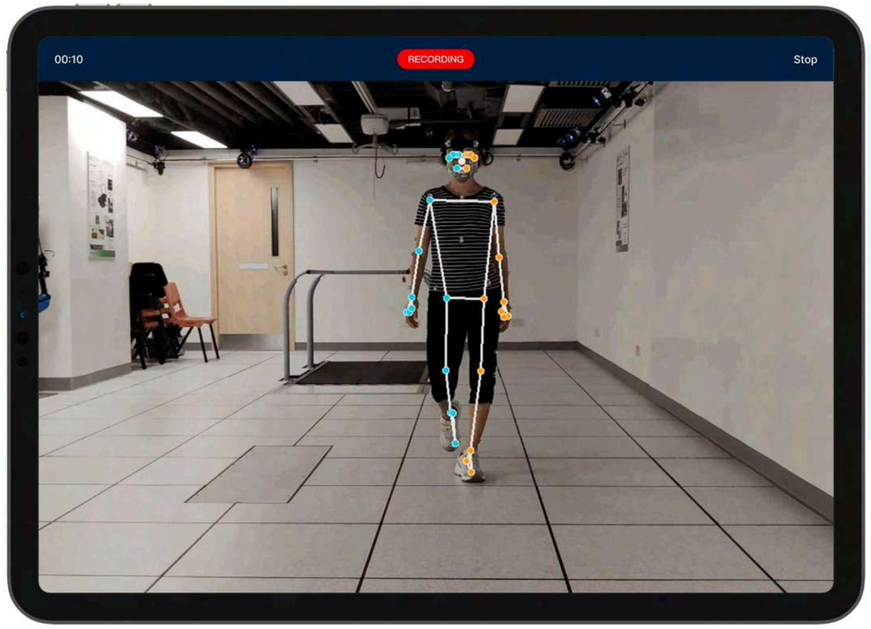
Community Rehabilitation

Refer to community clinics for preventive interventions

Refer to hospital for early treatment

- **Raise public awareness** on personal health management
- Enhance disease prevention through **early diagnosis**
- Reduce the **unwarranted use** of hospital services

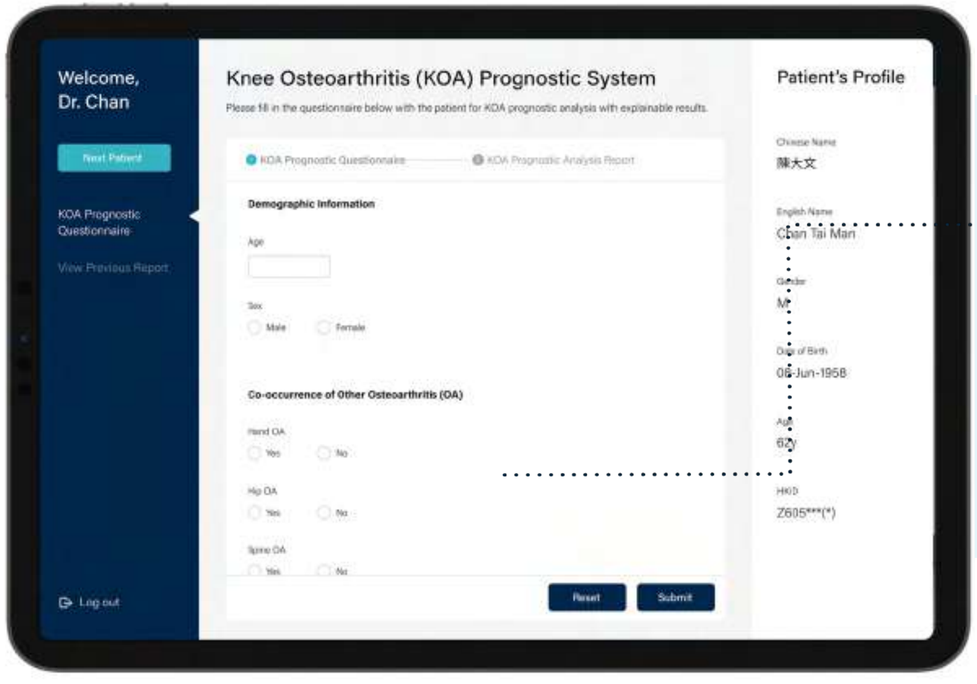
Implementation in Primary Healthcare



Video-baed Gait and Posture Analysis

- Advanced human motion capture
- Efficient setup
- Low-cost
- Requires only video by mobile device
- Automated and accurate estimation of gait parameters

Rapid, low-cost, accurate screening in the community



Basic Clinical Survey

1. Age
2. BMI
3. Living habits
4. Comorbidity
5. Symptoms
6. Basic clinical observations

Implementation in Primary Healthcare

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"From illness reactivity to wellness proactivity"

1	2	3	4
Health Promotion	Low-cost, Reliable Health Assessment	Effective Disease Management	Community Rehabilitation

Collaborating Partners

北區地區康健站 North DHC Express

YWCA 女青 香港基督教女青年會 Hong Kong Young Women's Christian Association

賽馬會智齡匯 JOCKEY CLUB SMART AGEING HUB 智得耆樂 • 活得自在 SMART AGE • SMART LIFE

保良局 PO LEUNG KUK

聖雅各福群會 St. James' Settlement

香港中文大學 CUHK 賽馬會公共衞生及基層醫療學院 Public Health The Jockey Club School of Public Health and Primary Care

香港明愛 Caritas HONG KONG

HONG KONG HOUSING SOCIETY 香港房屋協會

Implementation in Primary Healthcare

Health Promotion

- Educating patients and their caregivers on **exercise, lifestyle modification,** and **self-management skills**
- Promoting the importance of **regular checkups**

Implementation in Secondary Healthcare

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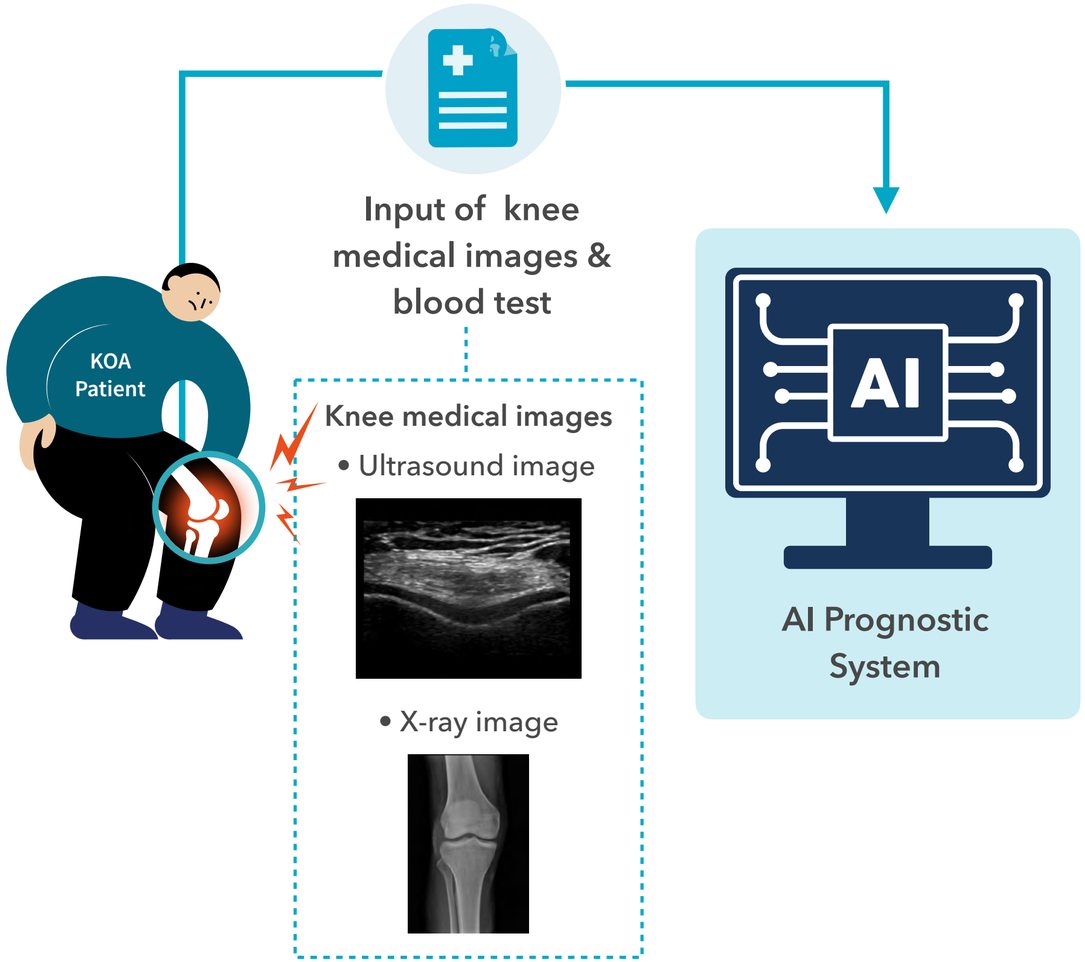
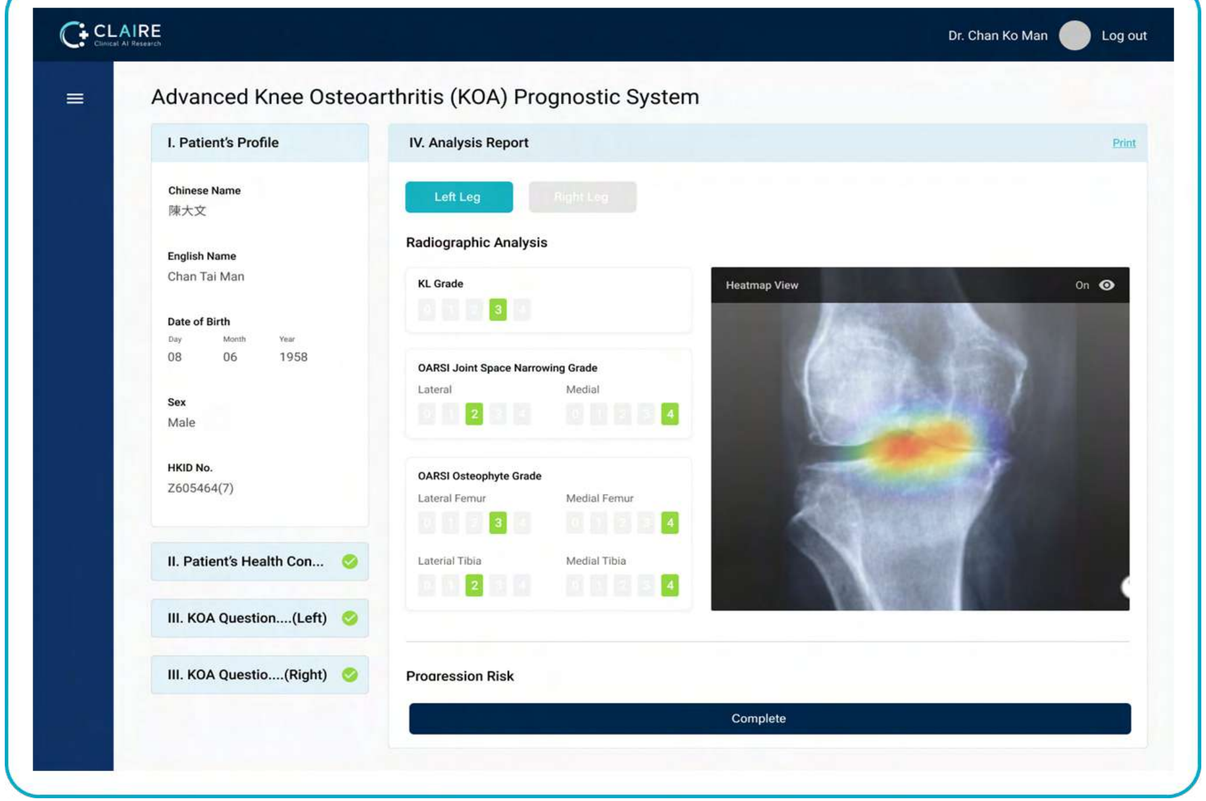
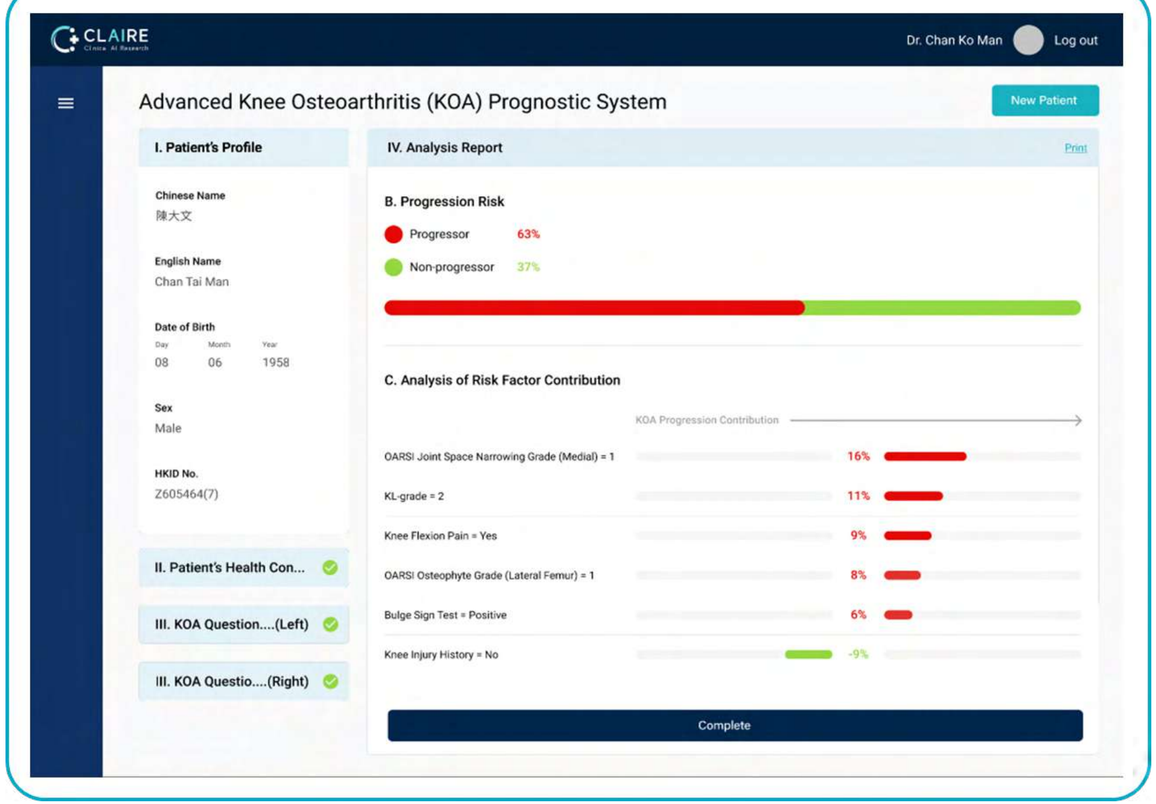
**Currently collaborating with public hospitals for clinical trial*



- Automatic grading
- Triage
- Personalised treatment
- Functional outcome measurement

Implementation in Secondary Healthcare





- Automatic medical image analysis for disease severity quantification
- Highlight high risk regions for clinical practitioners

- KOA Prognosis and disease trajectory prediction
- Explanation and dissection of the patient's high-risk factors detected by the AI system

One-Stop KOA Self-Management on Palm

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Empowering the public for KOA self-management at anytime, anywhere

Self-administrable in-app risk assessment

- Demographics
- Physiological characteristics
- Co-morbidities
- Living habits

Health Education

- Regular intelligible health information
- Personalised education

Health Exercises

- Simple and basic home exercise videos

Milestones and Trackrecord

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3 Journal Publications

3 Academic Presentations

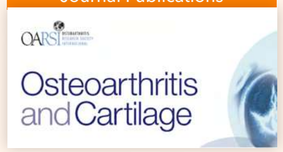
8 Innovation Awards

9 Entrepreneurship Awards

StartUpBeat · HKTDC HONG KONG MEANS BUSINESS · 東方日報 Oriental Daily News · TOPick hket.com · 晴報 SKY POST · 香港01 · 大公報 · UDN Lifestyle · 頭條日報 HEADLINE DAILY · 經濟通 etnet

Journal Publications

Journal Publications



Publication to **Osteoarthritis and Cartilage Journal** (Apr 2020)

Journal Publications

Publication to **Osteoarthritis and Cartilage Open** (Jan 2021)

Journal Publications

Publication to **MDPI Biology** (Nov 2021)

Academic Presentations

Academic Presentations

Invited presentation in the **2020 OARSI World Congress on Osteoarthritis** (May 2020)

Academic Presentations

Invited presentation in **Biomedical Engineering Conference 2020**, The Hong Kong Institution of Engineers (Nov 2020)

Academic Presentations

Invited presentation in **APRU Global Health Conference 2021** (Oct 2021)

Innovation Awards

Innovation Awards

PolyU Outstanding Work by Students (Oct 2020)

Innovation Awards

TechConnect Global Innovation Award (Nov 2020)

Innovation Awards

Champion of **Innovation for Future 2020 (Tertiary Stream)** (Apr 2021)

Innovation Awards

Winner of **MIT HealthHACK 2021 Future of Ageing (Caregiver Support)** (May 2021)

Innovation Awards

Winner of **Bupa Health Hack** (Jul 2021)

Innovation Awards

Deep Tech Pioneers, **Hello Tomorrow Global Challenge 2021** (Sep 2021)

Innovation Awards

Bronze Medalist of **Hong Kong ICT Student Innovation Award (Tertiary Stream)** (Dec 2021)

Innovation Awards

Awardee of **PolyU Student Entrepreneurial POC Funding Scheme** (Mar 2022)

Entrepreneurship Awards

Entrepreneurship Awards

Awardee of **PolyU Micro Fund 2020** (Jun 2020)

Entrepreneurship Awards

Grantee of **HKSTP STEP** (Jul 2020)

Entrepreneurship Awards

Awardee of **PolyU Lean LaunchPad Programme 2020** (Aug 2020)

Entrepreneurship Awards

Awardee of **Good Seed 2021** (May 2021)

Entrepreneurship Awards

Awardee of **PolyU Makerthon 2021** (May 2021)

Entrepreneurship Awards

Winner of **Hong Kong Trade Development Council Start-up Express 2021** (Jun 2021)

Entrepreneurship Awards

Champion and Most Feasible Video Award, **A.I. Future Tense Pitching Innotech Solutions, HSBC Future Skills Development Project** (Sept 2021)

Entrepreneurship Awards

Best Presentation Award of **Hong Kong Social Enterprise Challenge 2021-22** (Mar 2022)

Entrepreneurship Awards

Awardee of **HSBC Hub for the Future in Action** (May 2022)

Media Coverages

TV & Newspaper Coverages

StartUpBeat

HKTDC HONG KONG MEANS BUSINESS

東方日報 Oriental Daily News

TOPick hket.com

晴報 SKY POST

香港01

大公報

Lifestyle

經濟通 etnet

頭條日報 HEADLINE DAILY

理大研AI系統 預測膝骨關節炎

開發手機App助記錄數據 監察病情

理大生物醫學工程學系副教授溫春毅（中）指，膝骨關節炎預測系統可為患者提供早期診斷，輔助專科醫生作初步判斷，節省看症時間。（陳永康攝）

■本報記者 郭詩詩

系統作復康運動。

至於臨床醫療方面，系統可透過患者的膝骨關節X光圖像數據等自動計算惡化風險，在加上骨科醫生的判斷，將病人分為病情穩定、惡化緩慢或迅速，令患者接受更個人化的治療。

理大生物醫學工程學系副教授溫春毅指出，現時KOA新症患者要輪候公立醫院專科門診需時數年，系統可為患者提供早期診斷，數據亦可輔助骨科專科醫生作初步判斷，節省看症時間。

不過，該系統至今仍未能公開使用，理大正開發手機應用程式，讓患者可定期記錄個人情況數據，以作持續跟進及自我管理病情。

TOPick hket.com

理大研智能預警系統

防膝骨關節炎

【本報訊】公立醫院服務長期緊張，其中輪候全關節置換術預約手術時間更以年計，惟本港人口老化問題嚴峻，膝骨關節炎是一種高發性的老年疾病，若及早介入治療，可減緩惡化速度。香港理工大學生物醫學工程學系研發「膝骨關節炎人工智能預警/監測系統」讓社區及臨床醫療上，可盡早識別高風險人士，從而及早介入，並提升公眾自我管理能力。

該系統共收集美國數據庫超過一萬個膝骨關節樣本，並收集醫管局10萬個本地病人樣本，包括病歷及醫學圖像數據，團隊期望可提高對本地人口預測的準確度至90%。系統分為社區醫療及臨床醫療，團隊成員之一的理大生物醫學工程哲學碩士陳樂晉指，社區醫療系統設計對象予家庭醫生使用，以作評估風險。系統內設有23條包括生活習慣、心臟病史、過去有否曾做手術等問題，系統會作危險因子成分分析，危險因子愈多，膝關節惡化風險可能性愈高。

計劃5年內推向臨床試驗

而臨床醫療方面，系統可輔助骨科醫生準確預測。使用者輸入患者的危險因子資料，並輔以膝關節醫學圖像，例如超聲波及X光，系統會解釋惡化風險結果，再綜合骨科醫生意見，從而再制訂個人化治療。

理大生物醫學工程學系副教授溫春毅指，系統現時與醫管局港島西

東方日報 Oriental Daily News